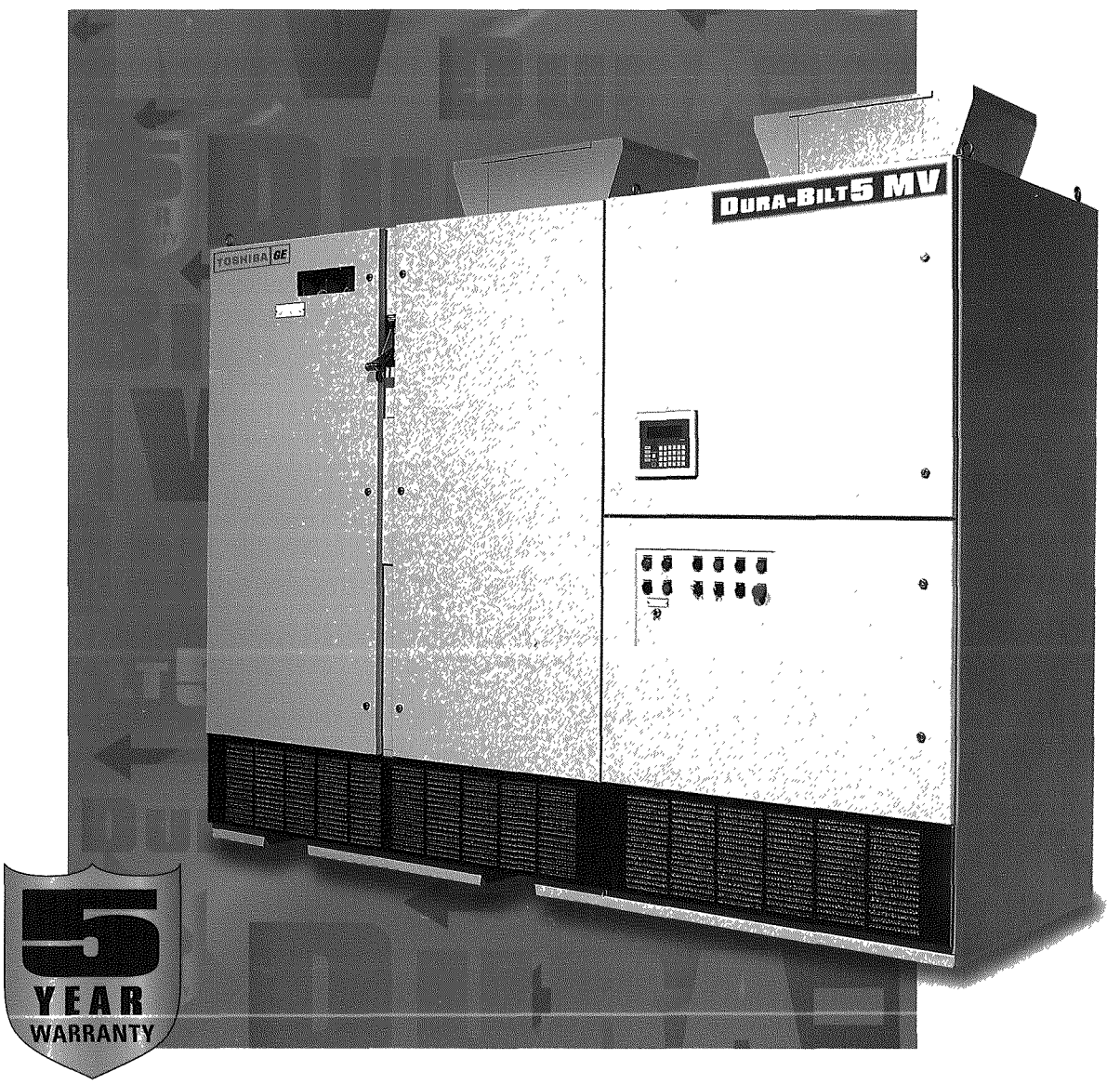
TOSHIBA GE

TOSHIBA GE AUTOMATION SYSTEMS CORPORATION



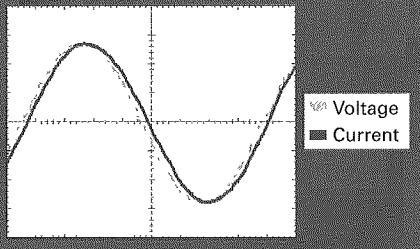
DURA-BILT5 MV

2000/3000/4000 Series Application Guide

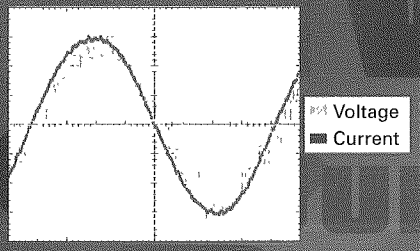
IP7_024866

GE and Toshiba have teamed up to design a family of medium voltage drives focused on **lowering your cost of ownership.**

Power System Friendly



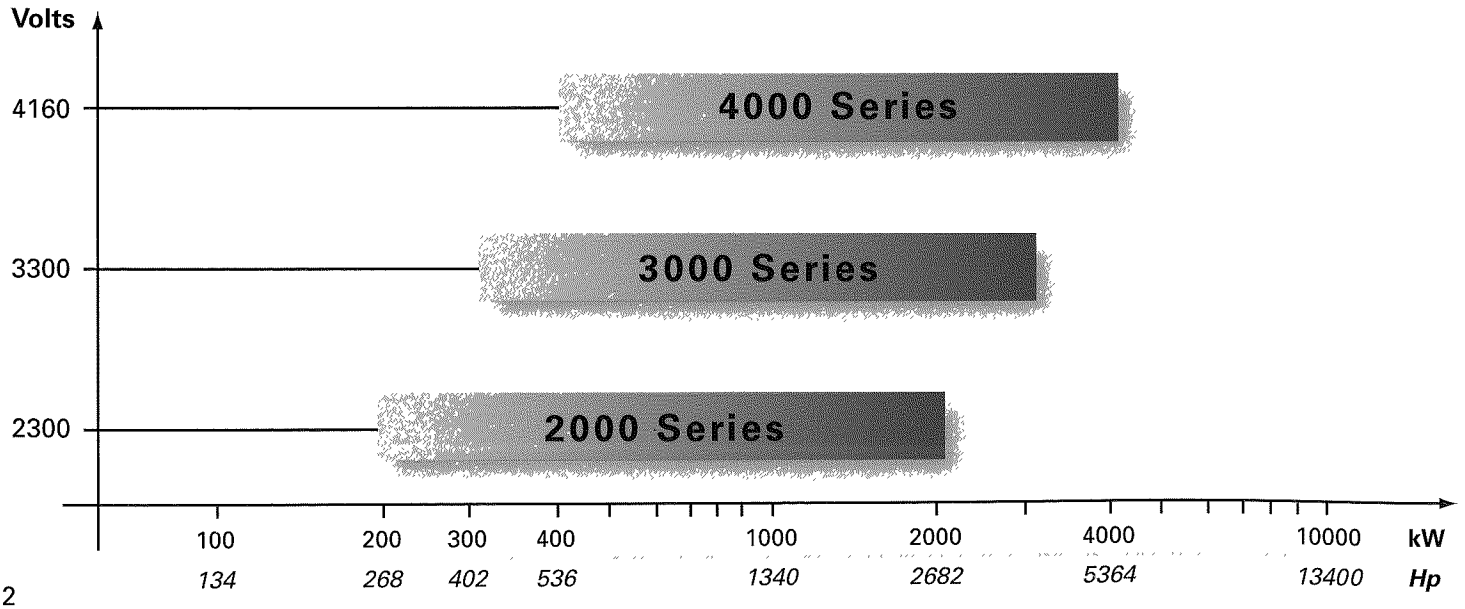
Motor System Friendly



Features	Benefits
Medium Voltage IGBTs Each inverter utilizes medium voltage Insulated Gate Bipolar Transistors (IGBTs).	**Rock Solid Reliability** These high-power IGBTs create a simpler, more reliable inverter design.
24-Pulse Converter Each phase leg of the converter includes a 24-pulse diode rectifier.	**Power System Friendly** This design exceeds the IEEE 519-1992 specification for Total Harmonic Distortion (THD) without requiring filters.
Heat Pipe Cooling Technology Heat pipe cooling technology is used in each of the three inverter phase legs.	**Compact Quiet Design** This form of cooling reduces the ambient noise and saves valuable floor space in your plant.
Windows-Based Configuration & Maintenance Tools For pc-based configuration, the Control System Toolbox features: • Animated block diagrams • Functionally organized parameters • Integrated trend window	**Faster Commissioning & Maintenance** These world-class tools drive productivity in commissioning and typical maintenance activities.

DURA-BILT5 MV

Covering a broad range of medium voltage drive applications.



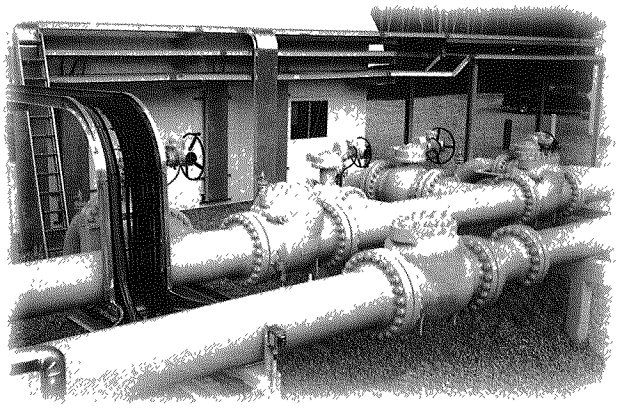
IP7_024867

Bringing Reliable Control To A Wide Variety Of Industries

Cement Plant

The Dura-Bilt5 MVs compartmentalized design streamlines installation, commissioning, and maintenance of medium voltage fans, mills, separators, and kilns. With a Mean Time Between Failure (MTBF) exceeding 16 years, the Dura-Bilt5 MV is engineered to deliver rock solid performance in virtually any application.

The Dura-Bilt5 MV family of drives can be seamlessly integrated with the rest of your pump or compressor station control system. They can be applied to existing motors and cabling, making them an excellent fit in modernization/retrofit applications.



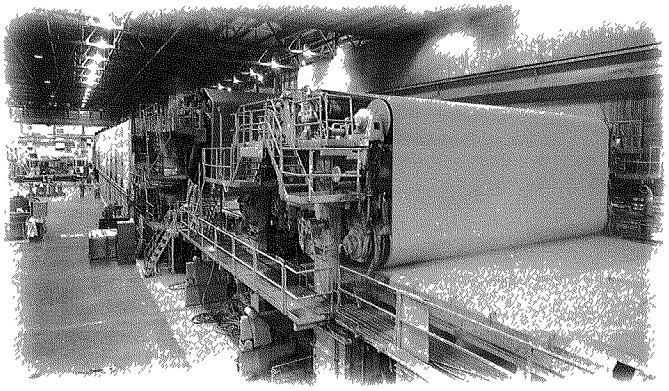
Pump Station

Mining Conveyor

Accurate torque control is a key in controlling large conveyors. The Dura-Bilt5 MV's flux vector algorithm provides the accuracy and response for this demanding application.

Traditional mechanical methods of controlling airflow are inefficient and require considerable maintenance. The Dura-Bilt5 MV provides more accurate and energy efficient control of airflow while eliminating the maintenance associated with dampers or vanes.

Induced Draft (ID) Fan In Cement Plant



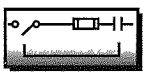
Paper Machine

In configuration and maintenance of coordinated drive systems, common pc-based tools are essential. The Dura-Bilt5 MV shares the same Toshiba GE Control System Toolbox Windows-based application with the entire family of Toshiba GE system drives and Innovation Series™ controllers.

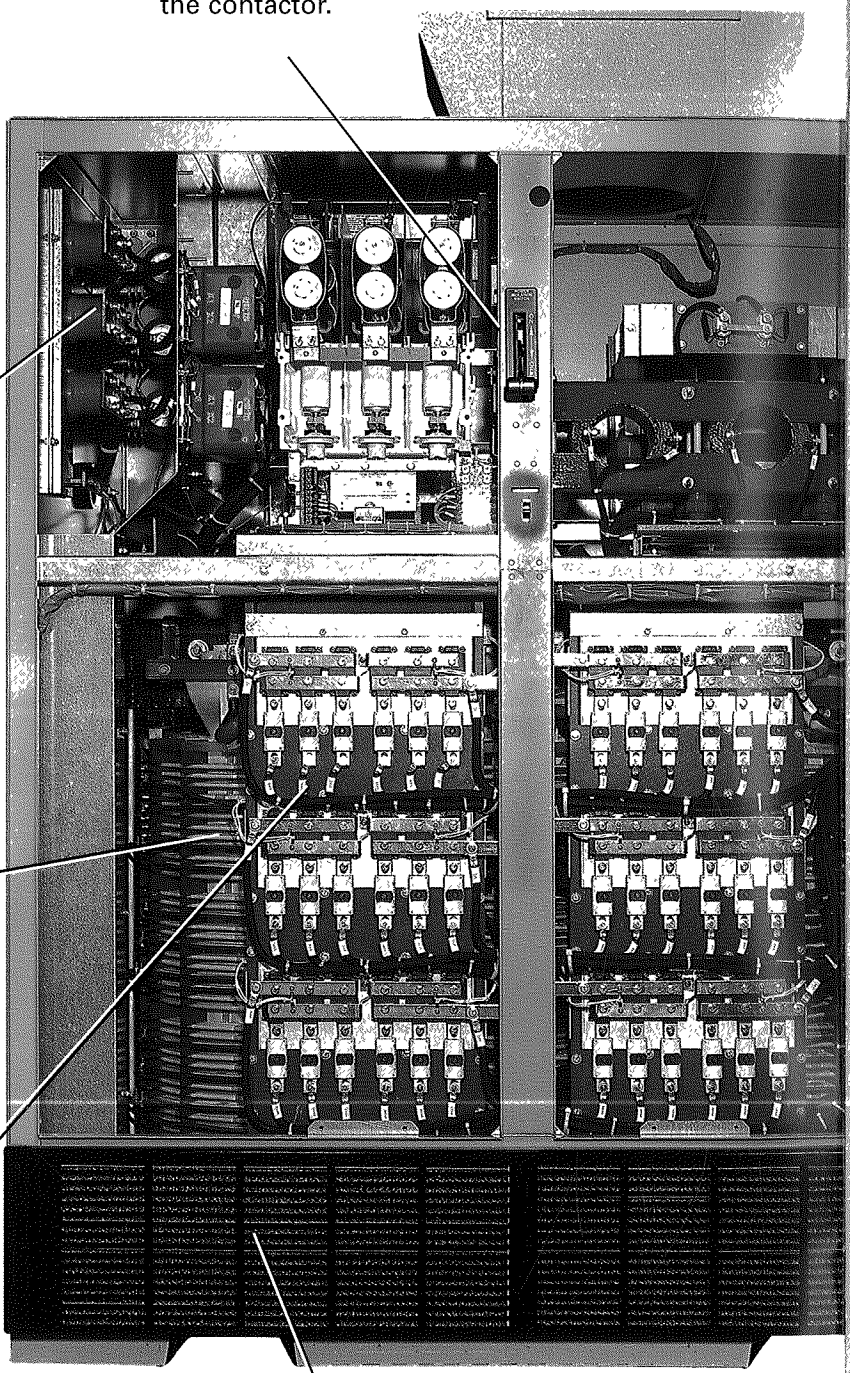
4000 Series 1600 kVA Frame - A Compact

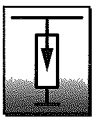
Differentiating Features:

- Compact design saves valuable floor space
- Compartmentalized design provides voltage class segregation and top or bottom cable feeds
- Copper wound integral transformer provides reliable operation and simplifies installation

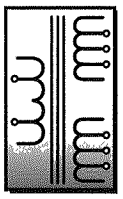


Input Power Disconnect – Option
A fused integral 3-phase disconnect option with vacuum contactor allows maintenance personnel to lockout or disable the drive. For additional safety, each of the high voltage doors is mechanically or electrically interlocked with the contactor.

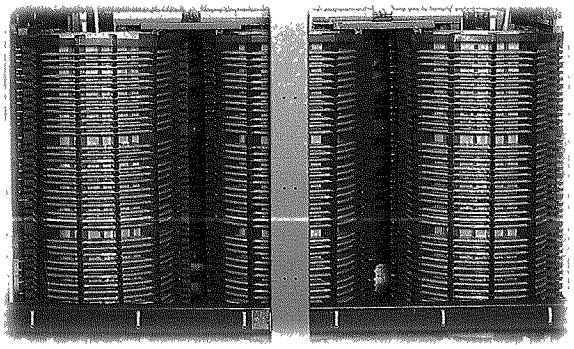


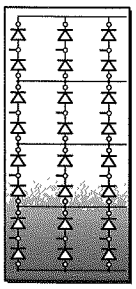


Lightning Arrestors – Standard
Incoming power (top or bottom fed) is protected by distribution class lightning arrestors for suppression of transient surges.

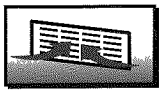


Copper Wound Isolation Transformer – Standard
An integral copper wound transformer is mounted in the rear of cabinet. It meets or exceeds standards established by ANSI/IEEE C57.12.91. Transformer is rated for 239°F *(115°C)* rise and its insulation system is rated at 428 °F *(220°C)*. An electrostatic shield is included for transient resistance.

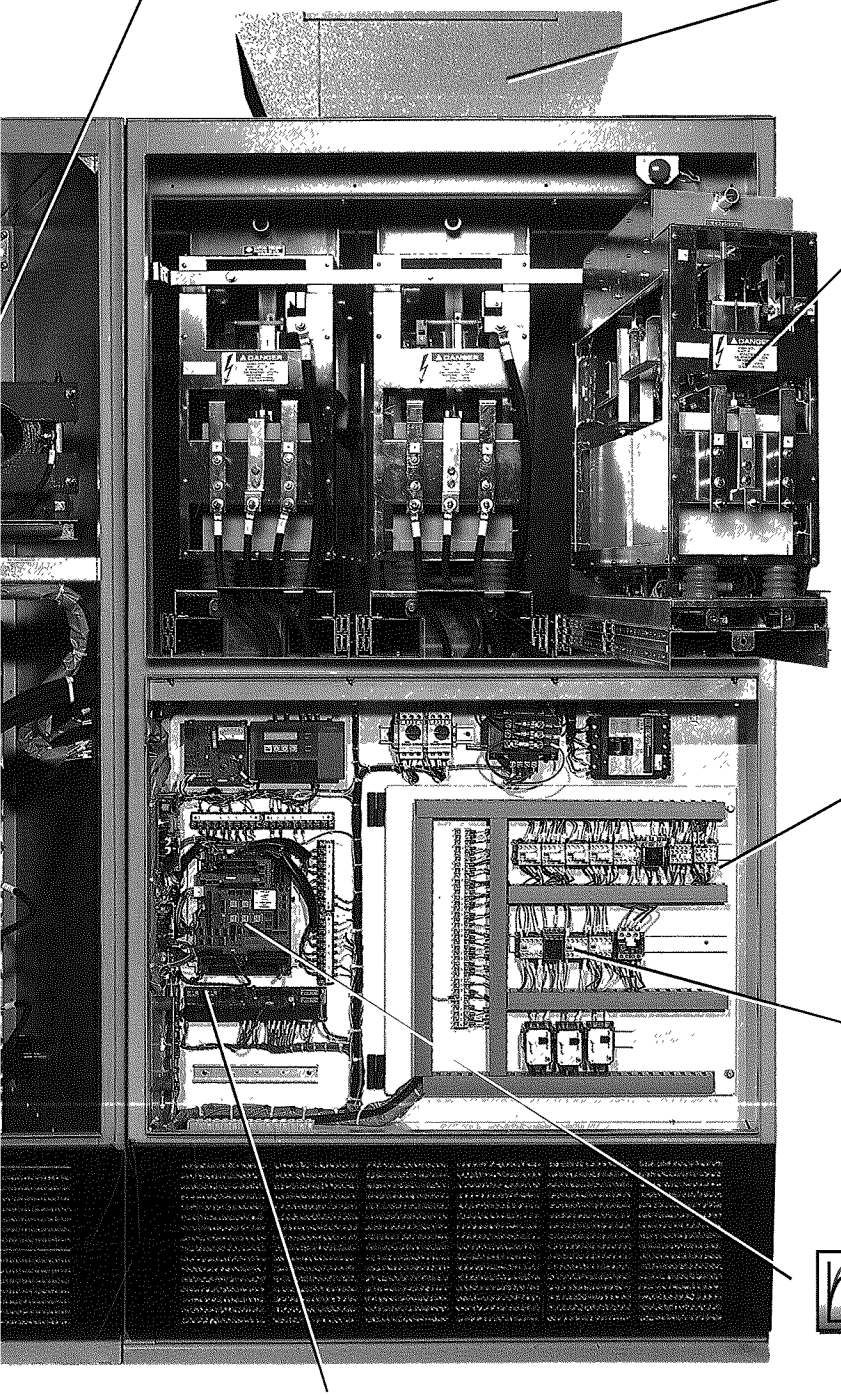




IEEE 519 Compliant 24-Pulse Source
Each phase leg has its own 24-pulse rectifier input. This design exceeds the IEEE 519-1992 stringent guidelines for input voltage and current distortion. The source diodes are mounted to an air-cooled extruded aluminum heat sink with fuse protection. Each fuse has blown fuse indication, and the dc bus is monitored for fuse loss.



Filtered Air Intake
Washable input air filters have front access for periodic maintenance.



Integral Pre-Charge AC Reactor
An ac reactor and medium voltage contactor control the charging of the dc bus, minimizing stress on the fusing and power components.

Blower Assemblies
Quiet (<80 dB @ 1 m) backward curved impeller fans circulate air throughout the enclosures, pulling air from the bottom filter assemblies and venting it out the top of the cabinets. Redundant fan assemblies can be provided as an option.

Roll Out Inverter Phase Leg Assemblies
The three modular phase leg assemblies include:
- Neutral point clamped power cell
- Medium voltage IGBTs
- DC bus capacitors, oil-filled for long life
- Gate driver circuit board
- Heat pipe cooling assembly
- 120 V ac to 15 V dc power supply
- Fiber optic link interface circuit board

A phase leg assembly can be easily rolled out (using heavy-duty slides) and replaced in 15 minutes for maintenance.

Motor Cabling Termination
Control panel swings out for access to motor cabling terminations. Both top and bottom motor cabling is supported as a standard.

Application Specific Controls
Each drive is matched to project requirements with custom control components mounted in this area.

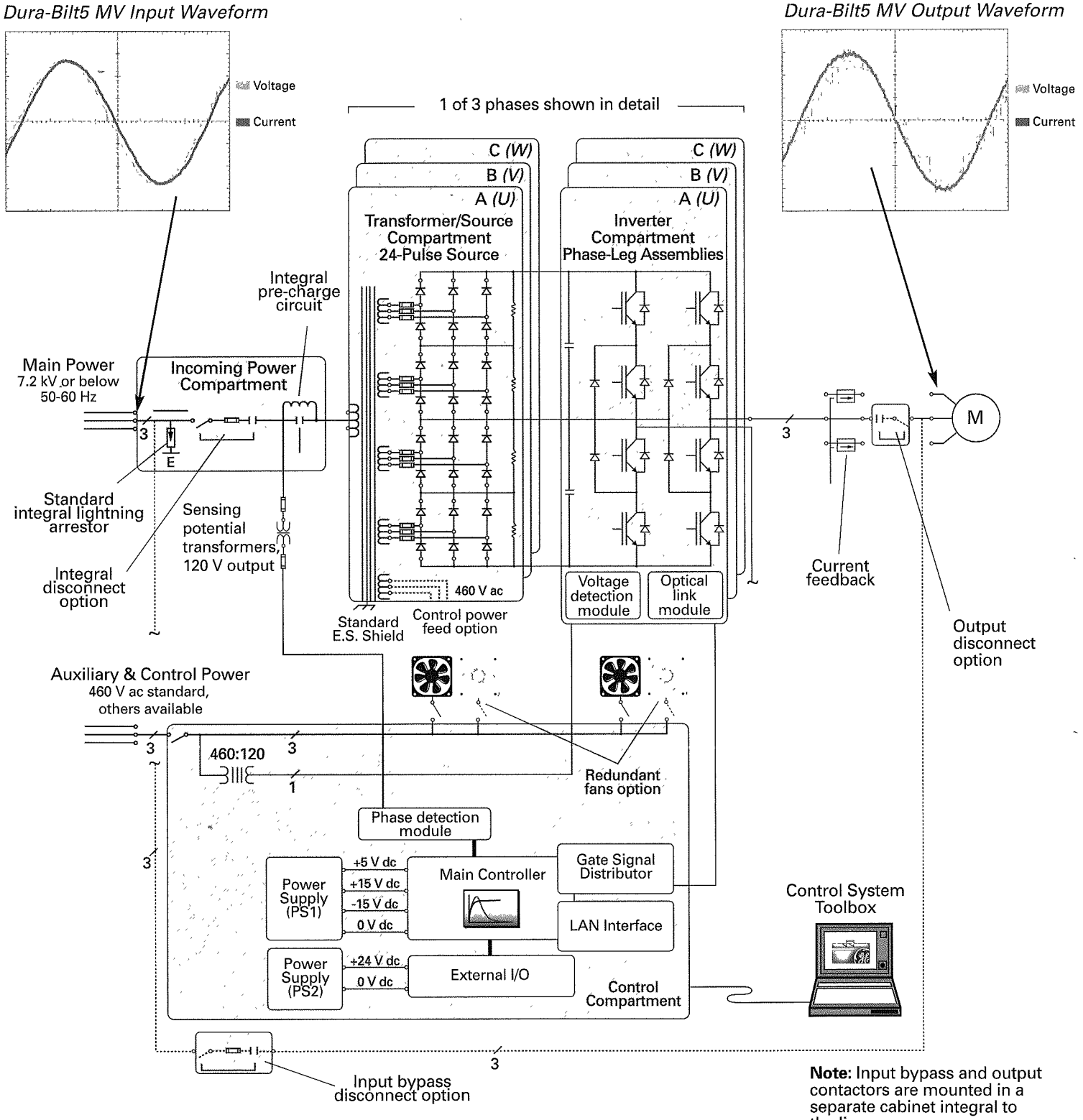
Control Functions
Each of the frames is available with either the Dura-Bilt5 or Dura-Bilt5i control boards. In both cases, the primary control board performs several control functions:
- Speed and torque regulation
- Sequencing
- I/O mapping
- Set of capture buffers
- Optional LAN interface board

The drive is configured from the Control System Toolbox.

I/O Board
Based on the application, 1 of 2 types of I/O boards is available (refer to page 8 for specifications). All I/O is terminated to a two-piece modular terminal block for ease of maintenance and troubleshooting.

DURA-BILT5 MV Power Bridge Technology

The Dura-Bilt5 MV power bridge design provides advantages over competing medium voltage technology in reliability, footprint, and maintenance.



Note: Input bypass and output contactors are mounted in a separate cabinet integral to the line-up.

IP7_024871

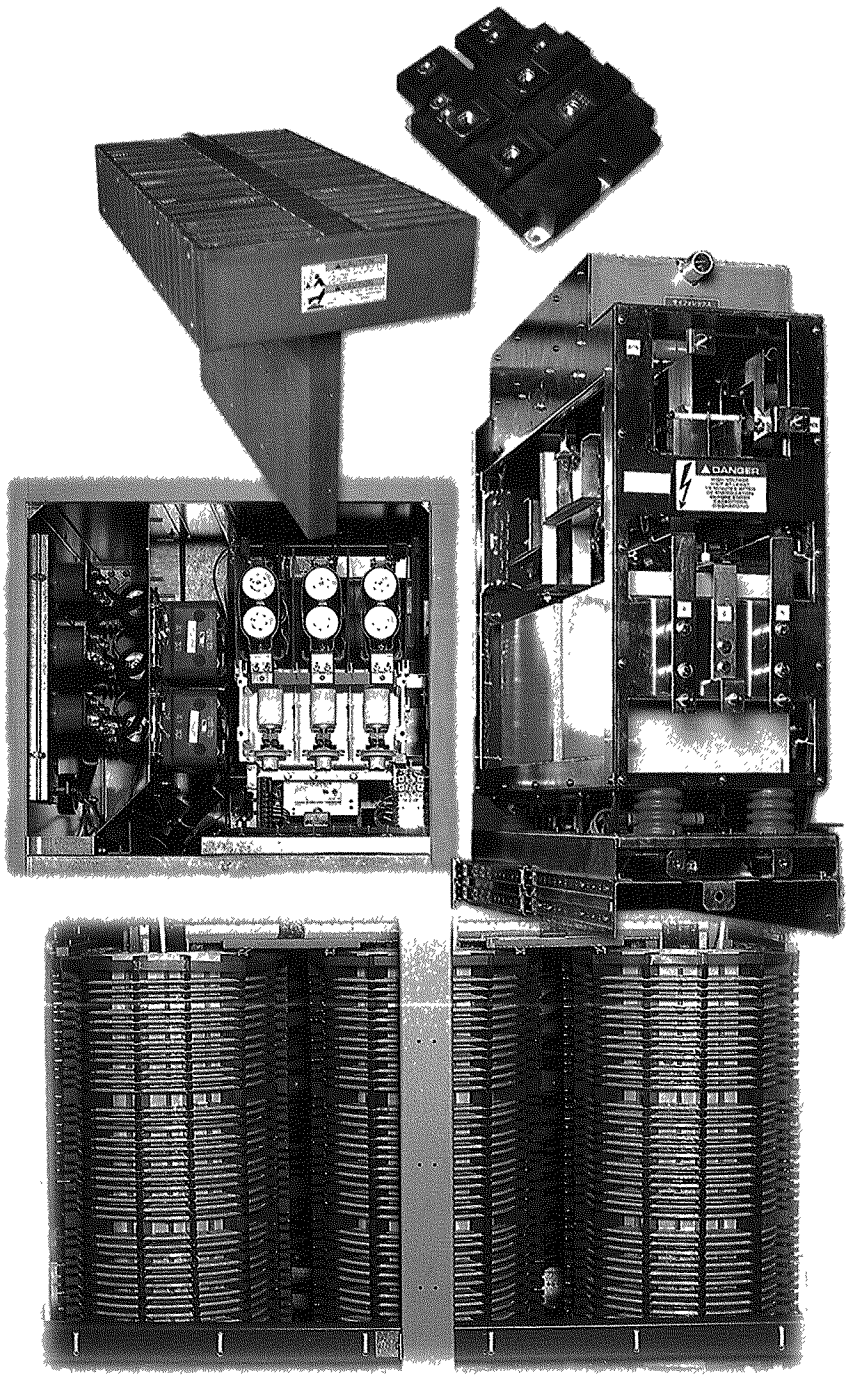
Driving The Five Year Warranty

5 YEAR WARRANTY

The design behind the warranty...

Designed to a Mean Time Between Failure (MTBF) of More than 16 Years

- Medium Voltage rated IGBTs minimizes the component count
- Neutral Point Clamped (NPC) power bridge topology improves motor waveform quality while maintaining efficiency
- Oil filled capacitors instead of limited life electrolytic type
- Copper wound 239°F *(115°C)* rise transformer with electrostatic shield standard
- Built in surge and transient protection
- Minimized transformer connections
- Conservative rating practices used on all components

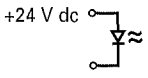
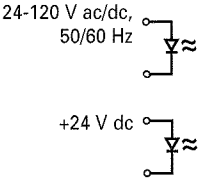
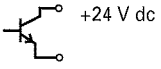
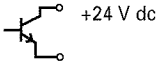
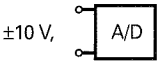
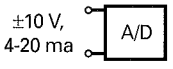
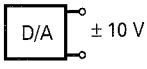
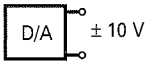
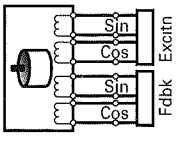
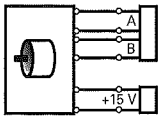
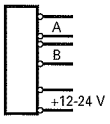
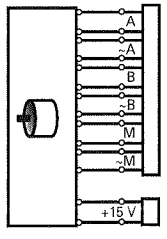
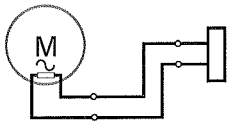


Minimized Component Count

- Reduced parts count achieved by using medium voltage IGBTs
- Fewer ancillary components compared to SGCT/GTO & IGCT technologies
- No water cooling (deionizers, pumps, heat exchangers)
- Designed to minimize the opportunity for failure (by using fewer parts) rather than distributing failure (by using redundant parts)

IP7_024872

A Control Offering To Fit Your Application

	Dura-Bilt5 I/O Offering	Dura-Bilt5i I/O Offering
PC-Based Configuration Tool Interface	• RS-232C interface • 9.6 kbps maximum	• Ethernet 10 Mbps • Single point or multi-drop configuration
Digital Inputs	 • Quantity 4 configurable mapping • Quantity 4 dedicated	 • Quantity 1 configurable mapping • Quantity 1 dedicated (hardware disable) • Quantity 6 configurable mapping
Digital Outputs	 • Open collector • Quantity 4 configurable mapping	 • Open collector • Quantity 4 configurable mapping • Quantity 2 user defined
Analog Inputs	 • Quantity 2, ±10 V • 12-bit resolution • Configurable mapping	 • Quantity 2, ±10 V or 4-20 mA, • Differential 8 kΩ impendence • 12-bit resolution • Configurable mapping
Analog Outputs	 • Quantity 2, ±10 V • Configurable gain, offset, and mapping • 8-bit resolution	 • Quantity 2, ±10 V • User defined • 8-bit resolution
Speed Feedback	 **Resolver** • Excitation freq of 1 kHz • Preferred source for resolvers is Tamagawa: www.tamagawa-seiki.co.jp  **Tachometer** • Maximum freq of 10 kHz • Drive provides 15 V dc  **Speed Tach Follower Output** • Maximum freq of 10 kHz • External 12-24 V dc is required	 **High Resolution Tachometer** • A Quad B with marker • Maximum freq of 125 kHz per channel • Differential 5 or 15 V dc • Drive provides 5 or 15 V dc @ 150 mA
LAN Interface Options	• DeviceNet • TOSLINE-S20	• DeviceNet • Profibus-DP • ISBus • TOSLINE-S20
Motor Temperature Feedback	 • High resolution torque motor temperature feedback • 1 kΩ platinum resistor or 100 Ω platinum RTD (RTD uses analog input with signal conditioner)	

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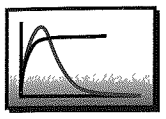


Between the Dura-Bilt5 and 5i controls, your application requirements are covered. In straightforward applications, the Dura-Bilt5 provides effective control. When advanced control or advanced diagnostic functionality is required, the Dura-Bilt5i can be applied. A few of the key features for these products are summarized below:

			Dura-Bilt5i MV Advanced Control Features				
Medium Voltage Drive Application	**Dura-Bilt5 MV Speed Sensor Required**	**Dura-Bilt5i MV Speed Sensor Required**	**High Performance Torque Regulation Without Motor Temperature Sensor**	**Transfer Motor To/From Line**	**Bumpless Transition From Tach To Tachless Operation**	**Motor Thermal Overload Class 10/20/30 Protection**	**Auto-Tune**
General Industry							
Pumps							
Centrifugal				✓		✓	✓
Reciprocating	✓					✓	✓
Fans							
Induced Draft				✓		✓	✓
Inline Fan						✓	✓
Compressors							
Centrifugal				✓		✓	✓
Reciprocating	✓					✓	✓
Mining & Cement							
Crushers	✓					✓	✓
Ball Mills	✓			✓		✓	✓
Conveyors	✓		✓	✓		✓	✓
Kilns	✓	✓	✓		✓	✓	✓
Rubber & Plastics							
Extruders	✓		✓			✓	✓
Pelletizers	✓					✓	✓
Mixers	✓	✓	✓		✓	✓	✓
Utilities							
Boiler Feed Pump				✓		✓	✓
ID, FD Fans				✓		✓	✓

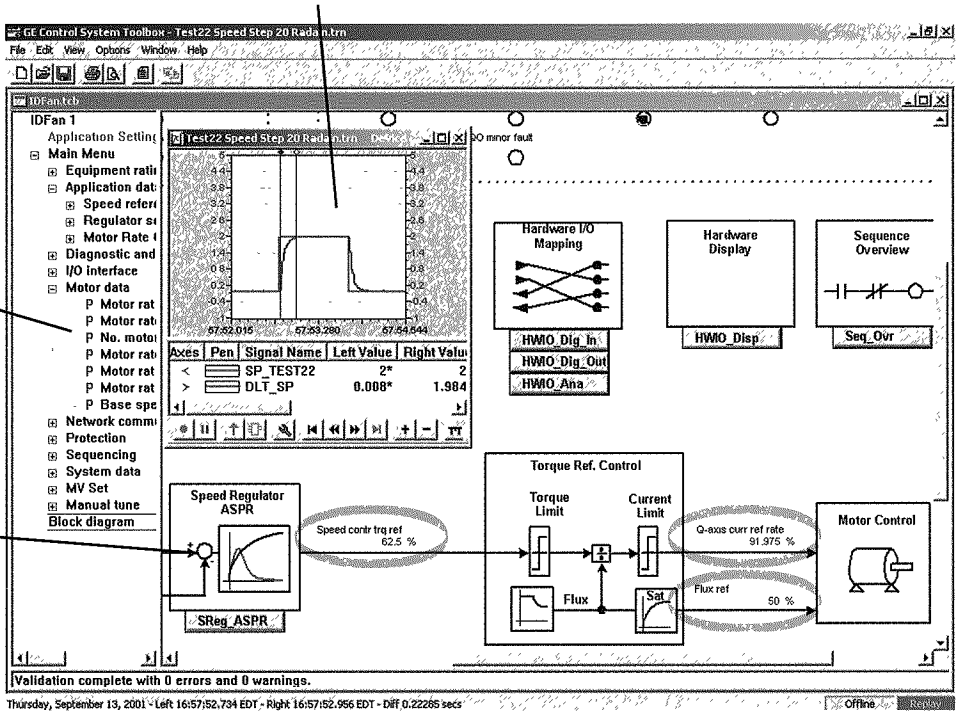
Drive/Motor Monitoring & Analysis

The 5 and 5i keypads, coupled with the Windows-based Control System Toolbox, bring productivity to your commissioning and maintenance activities.

Integrated Trend Window
The toolbox application has an integrated trend window that allows the user to:
- Define a trend with drag-and-drop variables from function block diagrams or select the variables from a list.
- Conduct online real time trending with the drive or upload the capture buffers in the drive for trending. For historical trending, define a link with integrated historian database.
- Quickly define a display with the auto scaling toolbar button.
- Analyze a specific time frame with the zoom in/out toolbar buttons.
- Create different views using variable hiding.
- Analyze specific times with cross hairs.
- Perform frequency-based analysis of the trend using the Fast Fourier Transform (FFT) function.

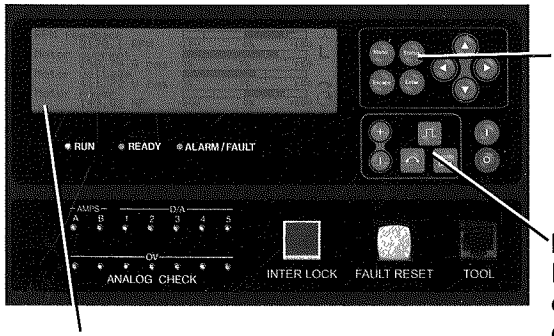
Outline View
Functionally organized parameters and variables allow quick access to any given function.

Animated Block Diagrams
Provides an animated graphical display of drive sequencing and regulation functions. Animated variables are shown in green, and the buttons are used to navigate to associated functions.



Control System Toolbox

Dura-Bilt5i Keypad

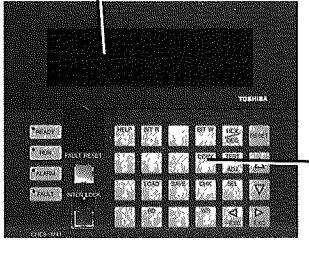


Parameter Editing
Intuitive menu interface for parameter editing.

Local Drive Control
Dedicated keys for local control of the drive for commissioning and maintenance activities.

Drive Status
Graphic status screen displays key variables in bar chart format with additional status icons.

Display Functions
- Speed/Current response
- Digital monitoring of data
- Fault history



Keypad Functions
- Parameter editing
- Memory card operation

Dura-Bilt5 Keypad

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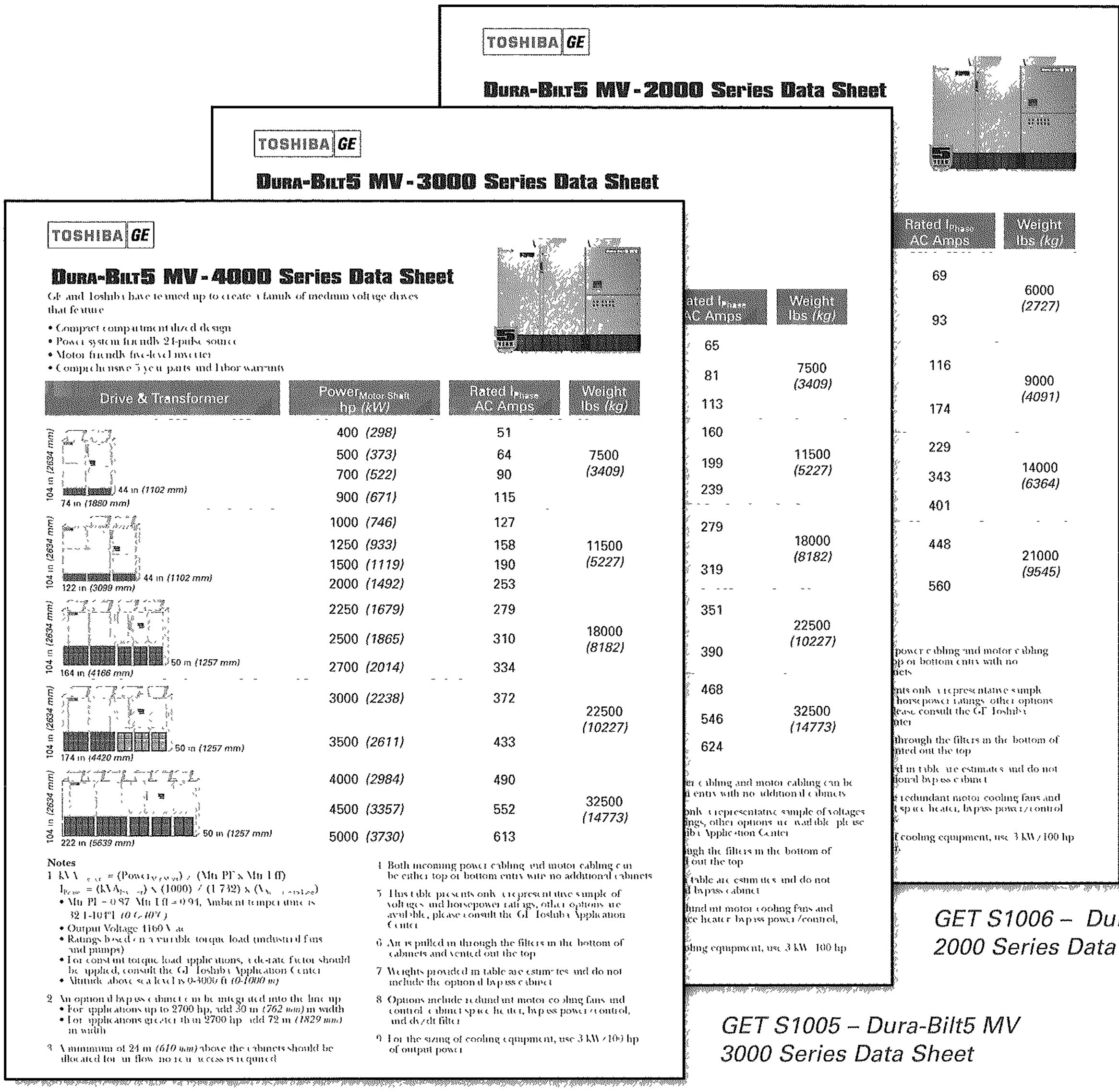
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Dura-Bilt5 MV-2000 Series Data Sheet

Dura-Bilt5 MV-3000 Series Data Sheet

Dura-Bilt5 MV-4000 Series Data Sheet

Drive & Transformer	Power hp (kW)	Rated I AC Amps	Weight lbs (kg)
	400 (298)	51	
	500 (373)	64	7500 (3409)
	700 (522)	90	
	900 (671)	115	
	1000 (746)	127	
	1250 (933)	158	11500 (5227)
	1500 (1119)	190	
	2000 (1492)	253	
	2250 (1679)	279	
	2500 (1865)	310	18000 (8182)
	2700 (2014)	334	
	3000 (2238)	372	22500 (10227)
	3500 (2611)	433	
	4000 (2984)	490	
	4500 (3357)	552	32500 (14773)
	5000 (3730)	613	

Notes

GET S1006 – Dura-Bilt5 MV 2000 Series Data Sheet

GET S1005 – Dura-Bilt5 MV 3000 Series Data Sheet

GET S1004 – Dura-Bilt5 MV 4000 Series Data Sheet

GE Industrial Systems

Lew Brown
Regional Account Manager
Solutions Sales
General Electric Company
3800 Lewiston St., Suite 400, Aurora, CO 80011
303 753-2261, DC 8 452-2261, Fax 303 753-2239*
Cell 303 229-3452
lewis.brown@indsys.ge.com

TOSHIBA GE

Global Office Locations:

GE Toshiba Automation Systems

USA: 1501 Roanoke Blvd, Salem VA, USA 24153
Tel: +1-540-387-5741; Fax: +1-540-387-7060

Europe: Via S. Girolamo 31/C Parco Massimo Bari Italy 70100
Tel: +39 080 534 1446; Fax: +39 080 534 0154

Asia: 1725 Pacific Trade Center, 2 KaiHing RD, Hong Kong
Tel: +852 27959988; Fax: +852 27958299

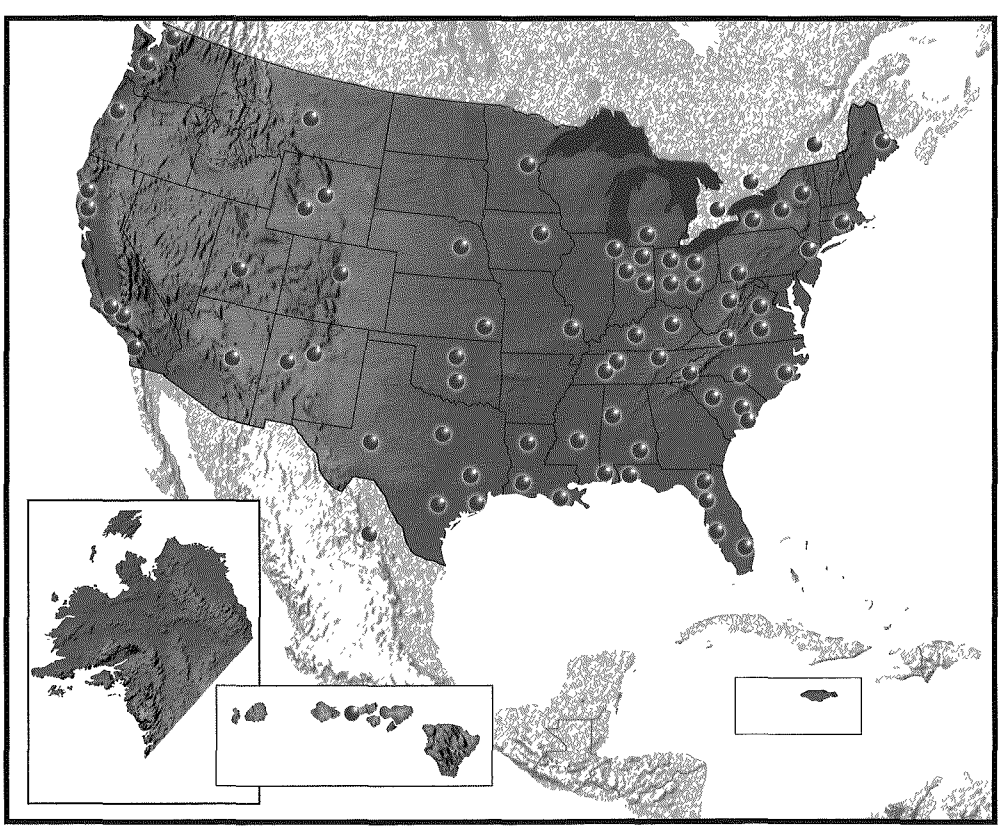
Toshiba GE Automation Systems Corporation

Japan: Mita 43 Mori Bildg 13-16 Mita, 3 chome, Minato-ku Tokyo 108-0073 Japan
Tel: +81-3-5444-3800; Fax: +81-3-5444-3810

When You Need Service, We Are Right Next Door

Toshiba GE uses the extensive infrastructure of GE service organizations to support its drive products over the long term. By using this network of fully trained personnel, you can be assured that your investment and trust in Toshiba GE products will be preserved for many years to come. GE also provides a full scope of services, ranging from process optimization to asset optimization—focusing on improving productivity and quality of production processes. Asset optimization focuses on the maintenance and management of physical and software assets employed by your business enterprise.

- Installation, Startup, & Commissioning
- Remote Monitoring & Diagnostic (RM&D)
- On-Demand Planned Service
- On-Demand Emergency Service
- Instrument Repair & Calibration
- Technical & Engineering Staffing
- Project Services
- Feasibility Studies
- Documentation
- Maintenance Programs
- Energy Asset Programs (EAP)
- Power Systems Management
- Energy Monitoring
- Engineering & Construction Management
- Projects with Financial Solutions
- Advanced Process Controls
- Custom Panel Design & Build
- Customizations, Modifications & Upgrades
- Tolerance Control
- Scrap Reduction Programs
- Technical Staffing & Training
- Preventative & Condition Based Maintenance
- Renewal Parts
- Parts Management



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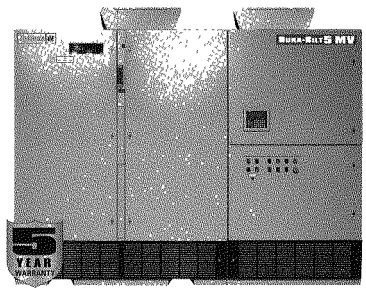
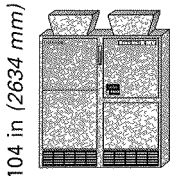
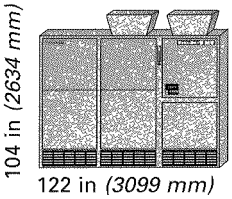
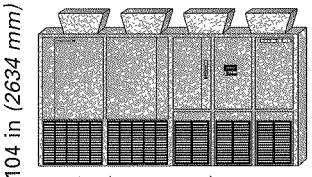
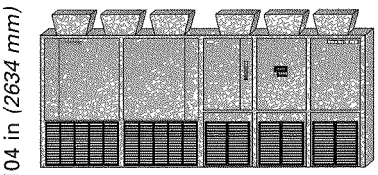
DURA-BILT5 MV-2000 Series Data Sheet



GE and Toshiba have teamed up to create a family of medium voltage drives that feature:

- Compact compartmentalized design
- Power system friendly 24-pulse source
- Motor friendly three-level inverter
- Comprehensive 5 year parts and labor warranty

Drive & Transformer	Power Motor Shaft hp *(kW)*	Rated I_{Phase} AC Amps	Weight lbs *(kg)*
 104 in *(2634 mm)* 44 in *(1102 mm)* 74 in *(1880 mm)*	300 (224)	69	6000 *(2727)*
	400 *(298)*	93	
 104 in *(2634 mm)* 44 in *(1102 mm)* 122 in *(3099 mm)*	500 *(373)*	116	9000 *(4091)*
	750 *(560)*	174	
 104 in *(2634 mm)* 50 in *(1257 mm)* 174 in *(4420 mm)*	1000 *(746)*	229	14000 *(6364)*
	1500 *(1119)*	343	
	1750 *(1306)*	401	
 104 in *(2634 mm)* 50 in *(1257 mm)* 222 in *(5639 mm)*	2000 *(1492)*	448	21000 *(9545)*
	2500 *(1865)*	560	

Notes

1. $kVA_{Inverter}$ = ($Power_{Mtr\ Shaft}$) / (Mtr PF x Mtr Eff)
   I_{Phase} = ($kVA_{Inverter}$) x (1000) / (1.732) x ($V_{Mtr\ Line\ to\ Line}$)
   - Mtr PF = 0.87, Mtr Eff = 0.94, Ambient temperature is 32°F-104°F *(0°C-40°C)*.
   - Output Voltage 2300 V ac.
   - Ratings based on a variable torque load (industrial fans and pumps).
   - For constant torque load applications, a de-rate factor should be applied, consult the GE Toshiba Application Center.
   - Altitude above sea level is 0-3000 ft *(0-1000 m)*.
2. An optional bypass cabinet can be integrated into the line up:
   - For applications up to 1750 hp, add 30 in *(762 mm)* in width.
   - For applications greater than 1750 hp, add 72 in *(1829 mm)* in width.
3. A minimum of 24 in *(610 mm)* above the cabinets should be allocated for air flow, no rear access is required.
4. Both incoming power cabling and motor cabling can be either top or bottom entry with no additional cabinets.
5. This table presents only a representative sample of voltages and horsepower ratings, other options are available, please consult the GE Toshiba Application Center.
6. Air is pulled in through the filters in the bottom of cabinets and vented out the top.
7. Weights provided in table are estimates and do not include the optional bypass cabinet.
8. Options include redundant motor cooling fans and control, cabinet space heater, bypass power/control, and dv/dt filter.
9. For the sizing of cooling equipment, use 3 kW/100 hp of output power.

Power Input 2200V - 7200V
(Top or Bottom Cable Entry)

Input Voltage Variation	+ 10/-5% continuous operating for main power
Input Frequency	50-60 Hz, ± 5%
Input Power Quality	THD ≤ 3% without filters Exceeds IEEE 519-1992
Surge Protection	Distribution class lightning arrestors are standard
Transformer	Transformer is rated for 239°F *(115°C)* rise and its insulation system is rated at 428°F *(220°C)*. A 3-phase electrostatic shield is standard, forced air cooling, optional control power secondary winding.
Source Type	AC fed 24-pulse diode, non-regenerative
Control Power	460 V ac, three-phase, or optional secondary feed from main power transformer
Control Power Line Dip/Ride Through	100 msec
Operating Displacement Power Factor	≥ 95% (includes transformer)

Motor Control

Speed Regulator Response	20 rad/s
Speed Regulator Error	± 0.01% FS with speed feedback ± 0.5% FS without speed feedback
Torque Regulator Response	500 rad/s
Torque Regulator Accuracy	± 3% FS with motor temperature sensor ± 30% FS without motor temperature sensor

Note: Refer to Dura-Bilt5 MV 2000, 3000, 4000 Series Application Guide (GET S1003) for additional technical information on these products.

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Power Output 2200V - 2400V
(Top or Bottom Cable Entry)

Output Frequency	0-120 Hz
Output Current Total Harmonic Distortion (THD)	≤ 3% Current ≤ 6% Voltage
Inverter Type, Modulation	Voltage source, Pulse Width Modulation (PWM), 3-level Neutral Point Clamped (NPC), modular draw-out phase leg assemblies, optically isolated from control
Power Semiconductor Technology	Medium Voltage Insulated Gate Bipolar Transistor (IGBT)

Environment

Operating Temperature	32°F-104°F *(0°C-40°C)* De-rate 1.5% per °C above 40°C to a maximum of 50°C
Storage Temperature	-13°F-158°F *(-25°C-70°C)*
Altitude	Up to 3300 ft *(0-1000 m)* with no de-rate Above 3300 ft *(0-1000 m)* with 3% de-rate per 1000 ft *(308 m)*
Humidity	≤ 95%, non-condensing
Audible Noise	≤ 80 dBA @ 3.1 ft *(1 m)*
Cooling	• Forced air with redundant cooling fans as an option • Separate source & inverter cooling paths • Inverter uses heat pipe technology for long IGBT life, compact size, and low ambient noise

Other

Efficiency	96.5% @ 60 Hz output frequency, including transformer
Agency Approvals	c UL

IP7_024879

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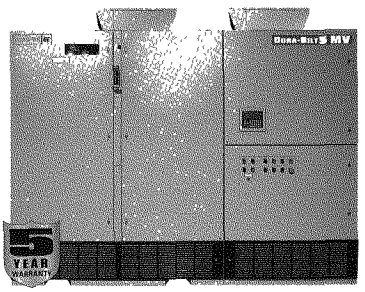
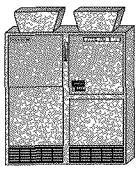
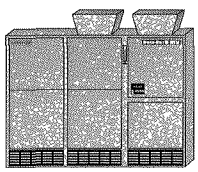
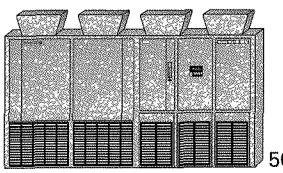
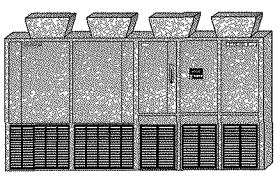
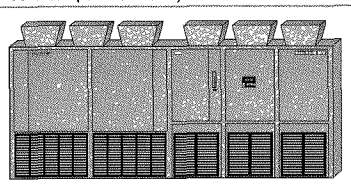
Dura-Bilt5 MV-3000 Series Data Sheet



GE and Toshiba have teamed up to create a family of medium voltage drives that feature:

- Compact compartmentalized design
- Power system friendly 24-pulse source
- Motor friendly five-level inverter
- Comprehensive 5 year parts and labor warranty

Drive & Transformer	Power Motor Shaft hp *(kW)*	Rated I_{Phase} AC Amps	Weight lbs *(kg)*
 104 in *(2634 mm)* 44 in *(1102 mm)* 74 in *(1880 mm)*	400 *(298)*	65	7500 *(3409)*
	500 *(373)*	81	
	700 *(522)*	113	
 104 in *(2634 mm)* 44 in *(1102 mm)* 122 in *(3099 mm)*	1000 *(746)*	160	11500 *(5227)*
	1250 *(933)*	199	
	1500 *(1119)*	239	
 104 in *(2634 mm)* 50 in *(1257 mm)* 164 in *(4166 mm)*	1750 *(1306)*	279	18000 *(8182)*
	2000 *(1492)*	319	
 104 in *(2634 mm)* 50 in *(1257 mm)* 174 in *(4420 mm)*	2250 *(1679)*	351	22500 *(10227)*
	2500 *(1865)*	390	
 104 in *(2634 mm)* 50 in *(1257 mm)* 222 in *(5639 mm)*	3000 *(2238)*	468	32500 *(14773)*
	3500 *(2611)*	546	
	4000 *(2984)*	624	

Notes

1. $kVA_{Inverter}$ = ($Power_{Mtr\ Shaft}$) / (Mtr PF x Mtr Eff)
   I_{Phase} = ($kVA_{Inverter}$) x (1000) / (1.732) x ($V_{Mtr\ Line\ to\ Line}$)
   - Mtr PF = 0.87, Mtr Eff = 0.94, Ambient temperature is 32°F-104°F *(0°C-40°C)*.
   - Output Voltage 3300 V ac.
   - Ratings based on a variable torque load (industrial fans and pumps).
   - For constant torque load applications, a de-rate factor should be applied, consult the GE Toshiba Application Center.
   - Altitude above sea level is 0-3000 ft *(0-1000 m)*.
2. An optional bypass cabinet can be integrated into the line up:
   - For applications up to 2000 hp, add 30 in *(762 mm)* in width.
   - For applications greater than 2000 hp, add 72 in *(1829 mm)* in width.
3. A minimum of 24 in *(610 mm)* above the cabinets should be allocated for air flow, no rear access is required.
4. Both incoming power cabling and motor cabling can be either top or bottom entry with no additional cabinets.
5. This table presents only a representative sample of voltages and horsepower ratings, other options are available, please consult the GE Toshiba Application Center.
6. Air is pulled in through the filters in the bottom of cabinets and vented out the top.
7. Weights provided in table are estimates and do not include the optional bypass cabinet.
8. Options include redundant motor cooling fans and control, cabinet space heater, bypass power/control, and dv/dt filter.
9. For the sizing of cooling equipment, use 3 kW/100 hp of output power.

IP7_024880

Power Input 2200V - 7200V
(Top or Bottom Cable Entry)

Input Voltage Variation	+ 10/-5% continuous operating for main power
Input Frequency	50-60 Hz, ± 5%
Input Power Quality	THD ≤ 3% without filters Exceeds IEEE 519-1992
Surge Protection	Distribution class lightning arrestors are standard
Transformer	Transformer is rated for 239°F *(115°C)* rise and its insulation system is rated at 428°F *(220°C)*. A 3-phase electrostatic shield is standard, forced air cooling, optional control power secondary winding.
Source Type	AC fed 24-pulse diode, non-regenerative
Control Power	460 V ac, three-phase, or optional secondary feed from main power transformer
Control Power Line Dip/Ride Through	100 msec
Operating Displacement Power Factor	≥ 95% (includes transformer)

Motor Control

Speed Regulator Response	20 rad/s
Speed Regulator Error	± 0.01% FS with speed feedback ± 0.5% FS without speed feedback
Torque Regulator Response	500 rad/s
Torque Regulator Accuracy	± 3% FS with motor temperature sensor ± 30% FS without motor temperature sensor

Note: Refer to Dura-Bilt5 MV 2000, 3000, 4000 Series Application Guide (GET S1003) for additional technical information on these products.

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Power Output 3200V - 3400V
(Top or Bottom Cable Entry)

Output Frequency	0-120 Hz
Output Current Total Harmonic Distortion (THD)	≤ 3% Current ≤ 6% Voltage
Inverter Type, Modulation	Voltage source, Pulse Width Modulation (PWM), 5-level Neutral Point Clamped (NPC), modular draw-out phase leg assemblies, optically isolated from control
Power Semiconductor Technology	Medium Voltage Insulated Gate Bipolar Transistor (IGBT)

Environment

Operating Temperature	32°F-104°F *(0°C-40°C)* De-rate 1.5% per °C above 40°C to a maximum of 50°C
Storage Temperature	-13°F-158°F *(-25°C-70°C)*
Altitude	Up to 3300 ft *(0-1000 m)* with no de-rate Above 3300 ft *(0-1000 m)* with 3% de-rate per 1000 ft *(308 m)*
Humidity	≤ 95%, non-condensing
Audible Noise	≤ 80 dBA @ 3.1 ft *(1 m)*
Cooling	• Forced air with redundant cooling fans as an option • Separate source & inverter cooling paths • Inverter uses heat pipe technology for long IGBT life, compact size, and low ambient noise

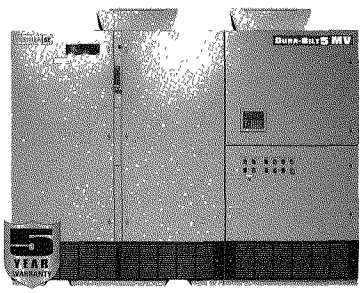
Other

Efficiency	96.5% @ 60 Hz output frequency, including transformer
Agency Approvals	c UL

IP7_024881

TOSHIBA | GE

Dura-Bilt5 MV - 4000 Series Data Sheet



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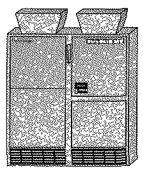
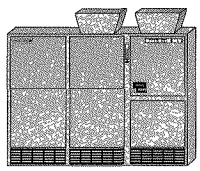
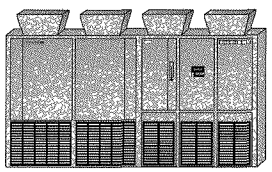
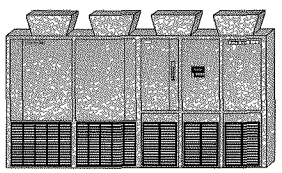
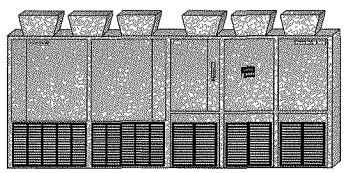
- Compact compartmentalized design
- Power system friendly 24-pulse source
- Motor friendly five-level inverter
- Comprehensive 5 year parts and labor warranty

Drive & Transformer	Power Motor Shaft hp *(kW)*	Rated I_{Phase} AC Amps	Weight lbs *(kg)*
 104 in *(2634 mm)*, 44 in *(1102 mm)*, 74 in *(1880 mm)*	400 *(298)*	51	7500 *(3409)*
	500 *(373)*	64	
	700 *(522)*	90	
	900 *(671)*	115	
 104 in *(2634 mm)*, 44 in *(1102 mm)*, 122 in *(3099 mm)*	1000 *(746)*	127	11500 *(5227)*
	1250 *(933)*	158	
	1500 *(1119)*	190	
	2000 *(1492)*	253	
 104 in *(2634 mm)*, 50 in *(1257 mm)*, 164 in *(4166 mm)*	2250 *(1679)*	279	18000 *(8182)*
	2500 *(1865)*	310	
	2700 *(2014)*	334	
 104 in *(2634 mm)*, 50 in *(1257 mm)*, 174 in *(4420 mm)*	3000 *(2238)*	372	22500 *(10227)*
	3500 *(2611)*	433	
 104 in *(2634 mm)*, 50 in *(1257 mm)*, 222 in *(5639 mm)*	4000 *(2984)*	490	32500 *(14773)*
	4500 *(3357)*	552	
	5000 *(3730)*	613	

Notes

1. $kVA_{Inverter}$ = ($Power_{Mtr\ Shaft}$) / (Mtr PF x Mtr Eff)
   I_{Phase} = ($kVA_{Inverter}$) x (1000) / (1.732) x ($V_{Mtr\ Line\ to\ Line}$)
   - Mtr PF = 0.87, Mtr Eff = 0.94, Ambient temperature is 32°F-104°F *(0°C-40°C)*.
   - Output Voltage 4160 V ac.
   - Ratings based on a variable torque load (industrial fans and pumps).
   - For constant torque load applications, a de-rate factor should be applied, consult the GE Toshiba Application Center.
   - Altitude above sea level is 0-3000 ft *(0-1000 m)*.
2. An optional bypass cabinet can be integrated into the line up:
   - For applications up to 2700 hp, add 30 in *(762 mm)* in width.
   - For applications greater than 2700 hp, add 72 in *(1829 mm)* in width.
3. A minimum of 24 in *(610 mm)* above the cabinets should be allocated for air flow, no rear access is required.
4. Both incoming power cabling and motor cabling can be either top or bottom entry with no additional cabinets.
5. This table presents only a representative sample of voltages and horsepower ratings, other options are available, please consult the GE Toshiba Application Center.
6. Air is pulled in through the filters in the bottom of cabinets and vented out the top.
7. Weights provided in table are estimates and do not include the optional bypass cabinet.
8. Options include redundant motor cooling fans and control, cabinet space heater, bypass power/control, and dv/dt filter.
9. For the sizing of cooling equipment, use 3 kW/100 hp of output power.

IP7_024882

Power Input 2200V - 7200V
(Top or Bottom Cable Entry)

Input Voltage Variation	+ 10/-5% continuous operating for main power
Input Frequency	50-60 Hz, ± 5%
Input Power Quality	THD ≤ 3% without filters Exceeds IEEE 519-1992
Surge Protection	Distribution class lightning arrestors are standard
Transformer	Transformer is rated for 239°F *(115°C)* rise and its insulation system is rated at 428°F *(220°C)*. A 3-phase electrostatic shield is standard, forced air cooling, optional control power secondary winding.
Source Type	AC fed 24-pulse diode, non-regenerative
Control Power	460 V ac, three-phase, or optional secondary feed from main power transformer
Control Power Line Dip/Ride Through	100 msec
Operating Displacement Power Factor	≥ 95% (includes transformer)

Motor Control

Speed Regulator Response	20 rad/s
Speed Regulator Error	± 0.01% FS with speed feedback ± 0.5% FS without speed feedback
Torque Regulator Response	500 rad/s
Torque Regulator Accuracy	± 3% FS with motor temperature sensor ± 30% FS without motor temperature sensor

Note: Refer to Dura-Bilt5 MV 2000, 3000, 4000 Series Application Guide (GET S1003) for additional technical information on these products.

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Power Output 4000V - 4200V
(Top or Bottom Cable Entry)

Output Frequency	0-120 Hz
Output Current Total Harmonic Distortion (THD)	≤ 3% Current ≤ 6% Voltage
Inverter Type, Modulation	Voltage source, Pulse Width Modulation (PWM), 5-level Neutral Point Clamped (NPC), modular draw-out phase leg assemblies, optically isolated from control
Power Semiconductor Technology	Medium Voltage Insulated Gate Bipolar Transistor (IGBT)

Environment

Operating Temperature	32°F-104°F *(0°C-40°C)* De-rate 1.5% per °C above 40°C to a maximum of 50°C
Storage Temperature	-13°F-158°F *(-25°C-70°C)*
Altitude	Up to 3300 ft *(0-1000 m)* with no de-rate Above 3300 ft *(0-1000 m)* with 3% de-rate per 1000 ft *(308 m)*
Humidity	≤ 95%, non-condensing
Audible Noise	≤ 80 dBA @ 3.1 ft *(1 m)*
Cooling	• Forced air with redundant cooling fans as an option • Separate source & inverter cooling paths • Inverter uses heat pipe technology for long IGBT life, compact size, and low ambient noise

Other

Efficiency	96.5% @ 60 Hz output frequency, including transformer
Agency Approvals	c UL

IP7_024883